1. Determine if the nondeterministic automaton

![Nondeterministic Automaton Diagram]

accepts the strings
(a) $bb$
(b) $ab$
(c) $aba$
(d) $\varepsilon$

or not. In each case, give all computations on the string in question.

2. Transform, using the subset construction, the nondeterministic finite automaton in Question 1 above into an equivalent deterministic finite automaton. Then delete the unreachable states. Show your working.

3. Convert each of the following NFAs to DFAs:

![NFA Diagrams]

4. Convert the following NFA to a DFA:

![NFA Diagram]

5. Convert the following NFA to a DFA using the subset construction:
6. Do the regular expressions \((aa \cup ab)^*\) and \((ba \cup ba)^*\) define the same language? What about \((ba \cup ab)^*\) and \((ba \cup ab)^*\)?

7. Describe in English the languages defined by the following regular expressions:
   - \((0 \cup 1)^*01\)
   - \(1^*01^*\)
   - \((11)^*\)
   - \((0^*10^*10^*)^*\)
   - \((0 \cup 1)^*01(0 \cup 1)^*\)
   - \(1^*0^*\)
   - \((10 \cup 0)^*(1 \cup 10)^*\)
   - \(0^*(1 \cup 000^*)^0^*\)

8. Find regular expressions defining the following languages over the alphabet \(\Sigma = \{a, b\}\):
   (a) all words starting with \(a\) and containing at least one \(b\);
   (b) all words of even length that do not contain \(ab\) as a sub-word;
   (c) all words containing an even number of \(a\)'s and an even number of \(b\)'s;
   (d) all words that do not have both of the sub-words \(bba\) and \(abb\).

9. Construct DFAs accepting the languages given by the following regular expressions:
   (a) \(aa^*bb^*\);
   (b) \((aa \cup ab)^*\).

10. Apply the procedure given in the lectures to convert the regular language \(L[\{0(0 \cup 11)^*(00 \cup 11)^11^*\}]\) to a finite automaton accepting it.

11. Construct NFAs accepting the languages given by the following regular expressions and convert them into DFAs:
    (a) \((1 \cup 0)^*101^*0^*\);
    (b) \(((10)^*00 \cup (11)^*1)^*\).